

Low Adherence to KDIGO 2012 CKD Clinical Practice Guidelines Despite Clear Evidence of Utility

Glen James, PhD^{1,a}, Juan Jose Garcia Sanchez, MPharm², Juan-Jesus Carrero, PhD³, Supriya Kumar, MSc⁴, Roberto Pecoits-Filho, MD^{5,6}, Hiddo J.L. Heerspink, PhD⁷, Stephen Nolan, PhD¹, Carolyn S.P. Lam, MD^{8,9}, Hungta Chen, PhD¹⁰, Eiichiro Kanda, PhD¹¹, Naoki Kashihara, MD¹¹, Matthew Arnold, PhD¹², Mikhail N. Kosiborod, MD¹³, Mitja Lainscak, PhD^{14,15}, Carol Pollock, PhD¹⁶ and David C. Wheeler, MD¹⁷

^aCurrent affiliation: Integrated Evidence Generation & Business Innovation, Bayer PLC, Reading, UK

¹*Global Medical Affairs, BioPharmaceuticals Medical, AstraZeneca, Cambridge, UK;*

²*Global Market Access and Pricing, BioPharmaceuticals Medical, AstraZeneca,*

Cambridge, UK; ³*Department of Medical Epidemiology and Biostatistics, Karolinska*

Institutet, Stockholm, Sweden; ⁴*Real World Data Science, BioPharmaceuticals*

Medical, AstraZeneca, Gaithersburg, MD, USA; ⁵*School of Medicine, Pontifical*

Catholic University of Parana, Curitiba, Brazil; ⁶*Arbor Research Collaborative for*

Health, Ann Arbor, MI, USA; ⁷*Department of Clinical Pharmacy and Pharmacology,*

University of Groningen, Groningen, Netherlands; ⁸*Department of Cardiology,*

National Heart Centre, Singapore; ⁹*Duke-NUS Medical School, Singapore;* ¹⁰*Medical*

and Payer Evidence Statistics, BioPharmaceuticals Medical, AstraZeneca,

Gaithersburg, MD, USA; ¹¹*Kawasaki Medical School, Kurashiki, Japan;* ¹²*Real World*

Data Science, BioPharmaceuticals Medical, AstraZeneca, Cambridge, UK; ¹³*Saint*

Luke's Mid America Heart Institute, University of Missouri-Kansas City, Kansas City,

MO, USA; ¹⁴Division of Cardiology, General Hospital Murska Sobota, Murska Sobota, Slovenia; ¹⁵Faculty of Medicine, University of Ljubljana, Ljubljana, Slovenia; ¹⁶Kolling Institute, Royal North Shore Hospital, University of Sydney, Sydney, NSW, Australia; and ¹⁷Department of Renal Medicine, University College London, London, UK

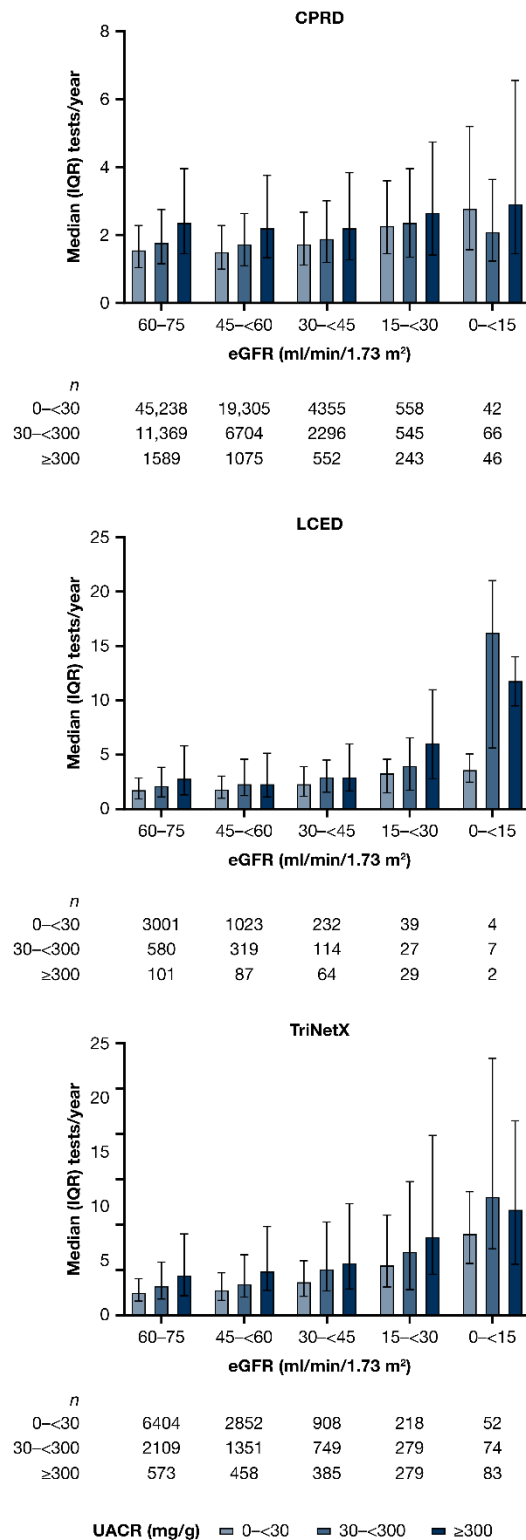
Supplementary Materials

Supplementary Table 1. Ascertainment of clinical outcomes

Outcome	Method of ascertainment
≥50% eGFR decline	Two consecutive eGFR measures recorded ≥28 days apart (date of the second measurement is considered as the date of the adverse event)
Kidney failure	Progression to CKD stage 5 (sustained eGFR ≤15 ml/min/1.73 m ²) or initiation of chronic RRT for >30 days (2 dialysis codes 30 to 365 days apart) or kidney transplant
hHF	Hospitalization code for HF
Stroke	Diagnostic code
MI	Diagnostic code
All-cause mortality	ONS record or date of death of patient – derived using a CPRD algorithm (CPRD); death in hospital record (TriNetX)
Cardiovascular mortality	Primary diagnostic code on death record (CPRD only)

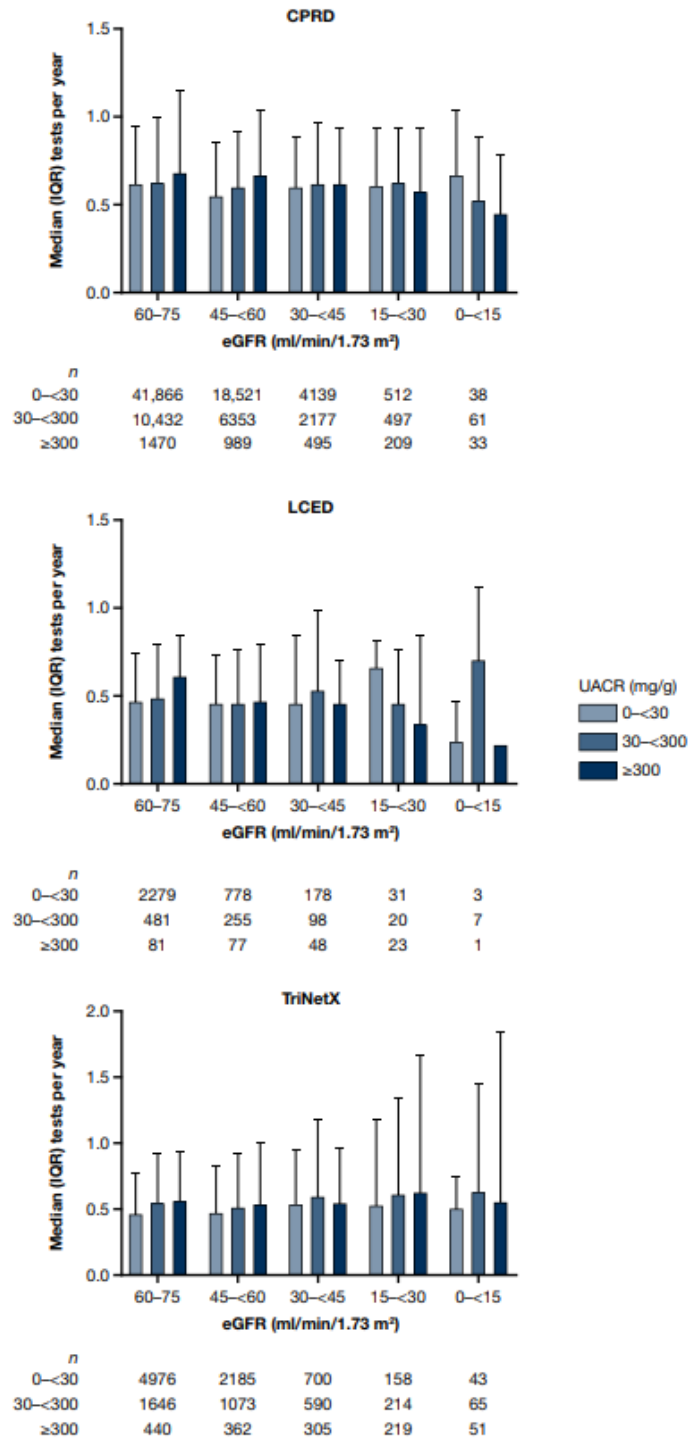
CKD, chronic kidney disease; CPRD, Clinical Practice Research Datalink; eGFR, estimated glomerular filtration rate; hHF, hospitalization for heart failure; MI, myocardial infarction; ONS, Office for National Statistics; RRT, renal replacement therapy.

Supplementary Figure 1. Frequency of eGFR testing per KDIGO category.



CPRD, Clinical Practice Research Datalink; eGFR, estimated glomerular filtration rate; IQR, interquartile range; KDIGO, Kidney Disease: Improving Global Outcomes; LCED, Limited Claims and Electronic Health Record Dataset; UACR, urinary albumin-to-creatinine ratio.

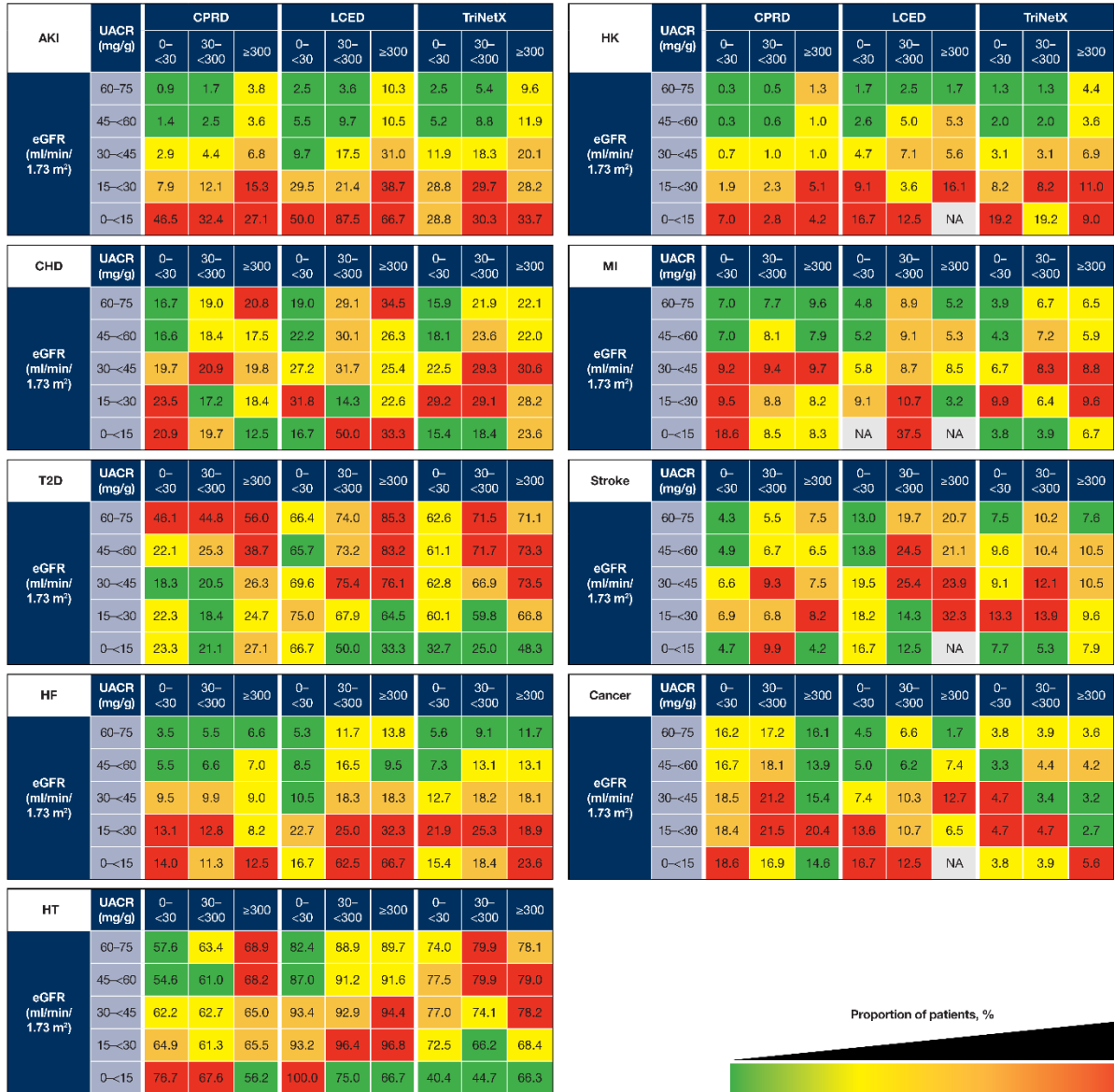
Supplementary Figure 2. Frequency of UACR testing per KDIGO category.



CPRD, Clinical Practice Research Datalink; eGFR, estimated glomerular filtration rate; IQR, interquartile range; KDIGO, Kidney Disease: Improving Global Outcomes; LCED, Limited Claims and Electronic Health Record Dataset; UACR, urinary albumin-to-creatinine ratio.

CPRD, LCED, and TriNetX data were from January 2008 to January 2020, January 2012 to June 2018, and January 2008 to March 2020, respectively.

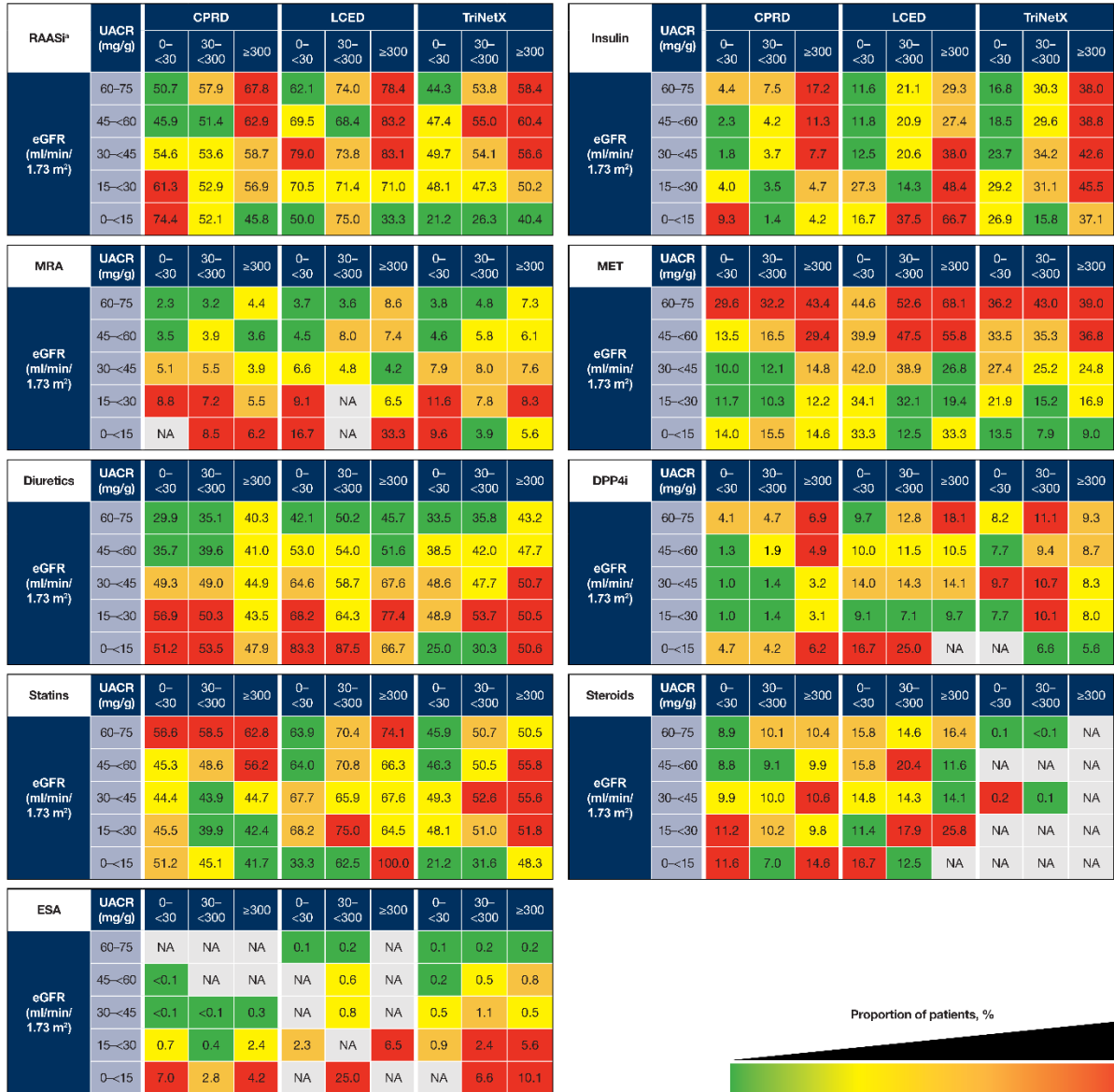
Supplementary Figure 3. Patient comorbidities/complications by KDIGO category at index.



AKI, acute kidney injury; CHD, coronary heart disease; CPRD, Clinical Practice Research Datalink; eGFR, estimated glomerular filtration rate; HF, heart failure; HK, hyperkalemia; HT, hypertension; KDIGO, Kidney Disease: Improving Global Outcomes; LCED, Limited Claims and Electronic Health Record Dataset; MI, myocardial infarction; T2D, type 2 diabetes; UACR, urinary albumin-to-creatinine ratio.

Values are % of patients; color coding is based on quartiles (Q) for each outcome within each database: green = Q1 and below; yellow = Q1 to Q2; orange = Q2 to Q3; red = Q3 and above.

Supplementary Figure 4. Prescription medications by KDIGO category at index.



ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; CPRD, Clinical Practice Research Datalink; DPP4i, dipeptidyl peptidase-4; eGFR, estimated glomerular filtration rate; ESA, erythropoiesis-stimulating agent; KDIGO, Kidney Disease: Improving Global Outcomes; LCED, Limited Claims and Electronic Health Record Dataset; MET, metformin; MRA, mineralocorticoid receptor antagonist; RAASi, renin-angiotensin-aldosterone system inhibitor; UACR, urinary albumin-to-creatinine ratio.

^aIncludes ACE inhibitors and ARBs. Values are % of patients; color coding is based on quartiles (Q) for each parameter within each database: green = Q1 and below; yellow = Q1 to Q2; orange = Q2 to Q3; red = Q3 and above.

Supplementary Figure 5. Laboratory parameters (in serum/whole blood) by KDIGO category at index.

Ferritin (ng/ml)	UACR (mg/g)	CPRD			LCED			TriNetX		
		0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	125.9	125.1	139.5	142.0	173.7	128.3	150.6	217.6	194.1
	45-60	129.1	140.1	154.1	146.2	249.6	102.4	147.6	191.4	216.7
	30-45	151.4	163.1	186.0	174.8	93.5	130.4	178.0	202.2	210.6
	15-30	166.2	180.4	220.7	124.9	52.7	215.8	128.4	237.8	246.3
	0-15	181.4	146.5	321.6	13.3	187.9	127.5	286.3	301.1	184.4

Bicarbonate (mmol/L)	UACR (mg/g)	CPRD			LCED			TriNetX		
		0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	26.6	26.5	26.2	26.4	26.3	26.0	26.6	26.4	26.2
	45-60	26.4	26.6	26.2	26.3	26.1	25.2	26.3	26.1	25.5
	30-45	26.2	25.4	25.2	25.7	25.0	24.4	25.9	25.4	25.4
	15-30	25.2	23.9	23.7	24.0	25.3	24.0	24.9	24.8	23.7
	0-15	22.3	20.9	22.7	20.2	21.5	24.7	24.0	23.1	22.0

Albumin (g/dL)	UACR (mg/g)	CPRD			LCED			TriNetX		
		0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	4.3	4.2	4.0	4.3	4.3	4.1	4.1	4.1	3.8
	45-60	4.2	4.2	4.0	4.3	4.2	3.9	4.1	4.0	3.8
	30-45	4.2	4.1	3.9	4.2	4.2	4.0	4.0	3.9	3.7
	15-30	4.1	4.0	3.8	4.1	3.9	3.9	3.9	3.9	3.7
	0-15	3.8	3.9	3.7	4.0	3.9	NA	3.8	3.7	3.7

Uric acid (μmol/L)	UACR (mg/g)	CPRD			LCED			TriNetX		
		0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	370.1	376.5	404.5	359.1	368.2	462.5	351.8	355.8	347.7
	45-60	388.8	395.2	419.6	368.4	390.6	392.9	368.9	385.9	393.5
	30-45	423.4	424.3	425.8	366.4	377.6	424.3	395.6	386.9	409.9
	15-30	424.6	424.8	456.8	444.8	452.1	455.0	399.1	404.8	420.1
	0-15	398.5	418.8	NA	NA	466.9	398.5	436.2	425.3	438.0

K ⁺ (mmol/L)	UACR (mg/g)	CPRD			LCED			TriNetX		
		0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	4.5	4.5	4.5	4.3	4.3	4.4	4.2	4.2	4.3
	45-60	4.5	4.5	4.6	4.3	4.3	4.3	4.2	4.3	4.3
	30-45	4.6	4.6	4.6	4.5	4.5	4.4	4.3	4.3	4.4
	15-30	4.7	4.7	4.8	4.4	4.6	4.6	4.5	4.5	4.5
	0-15	4.9	4.8	4.9	4.8	4.6	4.2	4.3	4.3	4.5

Hb (g/dL)	UACR (mg/g)	CPRD			LCED			TriNetX		
		0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	13.9	13.7	13.4	13.8	13.7	13.6	13.6	13.4	13.2
	45-60	13.6	13.4	13.0	13.5	13.5	13.1	13.2	12.9	12.7
	30-45	12.9	12.7	12.7	13.0	12.8	12.7	12.6	12.3	12.2
	15-30	12.2	11.9	11.9	11.9	12.0	11.3	11.9	11.7	11.5
	0-15	11.2	10.9	11.2	11.2	9.7	11.7	11.1	10.9	10.7

Creatinine (mg/dL)	UACR (mg/g)	CPRD			LCED			TriNetX		
		0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	1.0	1.0	1.1	1.0	1.0	1.1	1.0	1.0	1.1
	45-60	1.2	1.2	1.3	1.2	1.4	1.3	1.2	1.2	1.3
	30-45	1.4	1.5	1.6	1.5	1.5	2.2	1.5	1.6	1.6
	15-30	2.1	2.2	2.5	2.1	2.2	2.6	2.2	2.3	2.4
	0-15	4.7	4.3	4.8	3.8	4.0	4.1	5.6	5.7	5.1

Calcium (mg/dL)	UACR (mg/g)	CPRD			LCED			TriNetX		
		0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	9.4	9.4	9.3	9.5	9.5	9.5	9.4	9.4	9.4
	45-60	9.5	9.4	9.3	9.5	9.5	9.5	9.5	9.5	9.3
	30-45	9.4	9.4	9.3	9.5	9.5	9.5	9.4	9.4	9.2
	15-30	9.5	9.2	9.2	9.5	9.3	9.2	9.4	9.3	9.1
	0-15	8.9	9.1	9.1	9.0	8.6	9.1	8.8	8.9	8.9

BNP (pg/ml)	UACR (mg/g)	CPRD			LCED			TriNetX		
		0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	NA	NA	NA	170.3	414.1	143.0	224.7	215.7	275.7
	45-60	NA	NA	NA	245.3	244.9	63.5	218.4	309.3	302.1
	30-45	NA	NA	NA	102.6	511.2	78.7	342.6	345.2	493.8
	15-30	NA	NA	NA	452.0	801.3	112.7	371.4	447.9	522.2
	0-15	NA	NA	NA	NA	291.5	358.0	204.4	593.9	916.0

Sodium (mmol/L)	UACR (mg/g)	CPRD			LCED			TriNetX		
		0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	140.1	139.7	139.4	139.7	139.4	139.5	139.3	138.8	138.4
	45-60	140.1	139.9	139.4	139.8	139.2	139.4	139.2	138.8	138.6
	30-45	139.7	139.6	139.3	139.4	139.4	138.6	139.0	138.7	138.9
	15-30	139.4	139.4	139.5	138.7	140.0	138.8	137.7	138.5	138.1
	0-15	138.6	138.6	138.3	136.2	139.0	142.0	137.1	137.4	138.0

CRP (mg/L)	UACR (mg/g)	0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	10.4	15.0	17.9	13.4	18.8	24.5	8.3	7.4	9.9
	45-60	12.3	17.5	18.7	15.5	26.7	35.4	9.4	16.0	13.2
	30-45	21.3	20.9	26.1	7.1	4.0	12.6	11.7	12.7	5.6
	15-30	27.6	31.8	31.3	NA	51.9	3.0	18.9	7.6	8.9
	0-15	35.4	33.4	83.8	NA	NA	NA	88.7	11.5	5.0

LDL (mmol/L)	UACR (mg/g)	0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	2.7	2.6	2.6	2.5	2.4	2.5	2.4	2.3	2.5
	45-60	2.9	2.7	2.7	2.5	2.4	2.5	2.4	2.3	2.4
	30-45	2.8	2.7	2.8	2.4	2.4	2.7	2.4	2.2	2.4
	15-30	2.8	2.7	2.9	2.5	2.1	2.8	2.4	2.2	2.3
	0-15	2.2	3.1	3.1	2.1	2.7	2.1	2.3	2.3	2.4

HDL (mmol/L)	UACR (mg/g)	0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	1.3	1.3	1.3	1.3	1.2	1.1	1.3	1.2	1.2
	45-60	1.4	1.4	1.3	1.3	1.2	1.2	1.3	1.2	1.2
	30-45	1.4	1.4	1.3	1.3	1.2	1.2	1.3	1.2	1.2
	15-30	1.4	1.3	1.2	1.2	1.1	1.3	1.3	1.2	1.1
	0-15	1.2	1.2	1.4	1.1	0.8	1.4	1.1	1.0	1.3

Transferrin saturation (%)	UACR (mg/g)	0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	27.3	26.8	27.1	24.7	25.0	18.3	22.5	23.1	23.9
	45-60	28.0	24.2	24.8	24.6	22.0	21.3	22.1	19.9	21.1
	30-45	23.5	28.1	21.2	23.5	24.7	17.9	22.3	22.8	23.1
	15-30	33.4	23.8	40.3	52.9	24.2	22.5	20.9	21.8	20.3
	0-15	NA	NA	NA	22.3	18.5	18.3	24.5	20.0	25.5

TIBC (µg/dL)	UACR (mg/g)	0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	314.3	318.1	301.6	337.9	319.9	378.4	340.9	329.1	318.8
	45-60	302.7	318.1	292.3	332.6	329.6	329.0	328.5	326.1	303.6
	30-45	281.5	308.9	277.5	307.8	330.2	326.6	326.6	309.5	293.3
	15-30	247.2	252.3	221.4	266.0	257.5	284.1	311.7	281.2	270.7
	0-15	NA	NA	NA	NA	245.3	277.5	267.8	262.8	245.6

Phosphate (mmol/L)	UACR (mg/g)	0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	1.1	1.1	1.1	1.1	1.0	1.1	NA	NA	NA
	45-60	1.1	1.1	1.1	1.1	1.1	1.2	NA	NA	NA
	30-45	1.1	1.1	1.2	1.0	1.1	1.2	NA	NA	NA
	15-30	1.2	1.2	1.2	1.0	1.1	1.3	NA	NA	NA
	0-15	1.5	1.4	1.6	2.2	1.5	1.2	NA	NA	NA

WBC Count (10 ⁹ /L)	UACR (mg/g)	0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	7.4	7.6	8.1	8.4	8.7	8.0	NA	NA	NA
	45-60	7.3	7.7	8.1	7.9	10.3	7.8	NA	NA	NA
	30-45	7.6	7.9	8.1	7.5	7.4	NA	NA	NA	NA
	15-30	7.9	8.3	8.3	NA	NA	6.6	NA	NA	NA
	0-15	9.2	9.3	8.8	NA	17.2	NA	NA	NA	NA

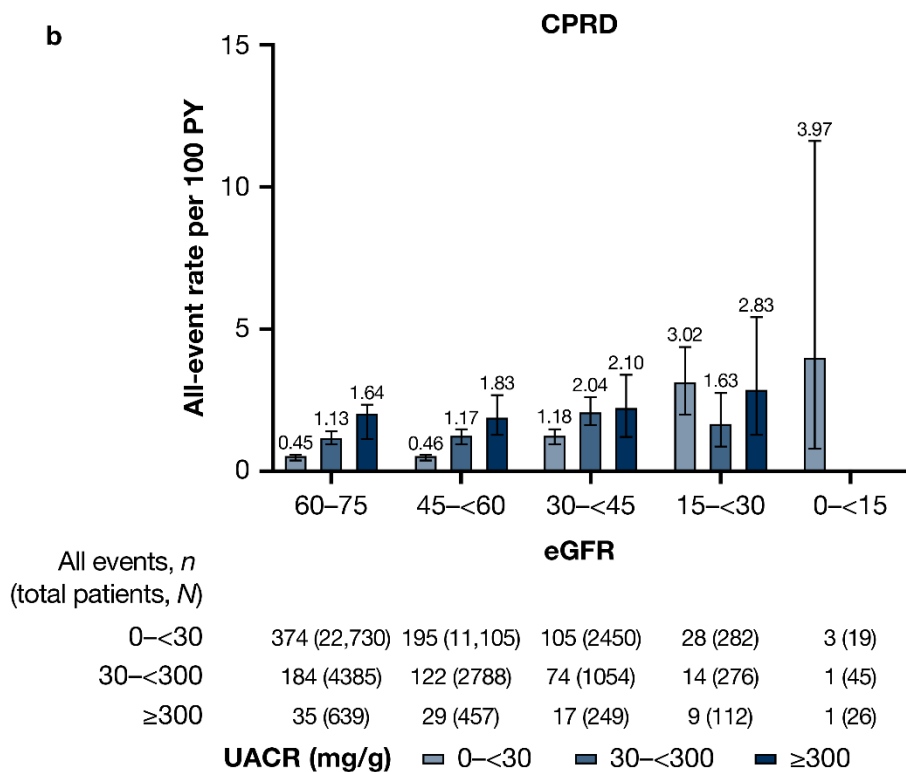
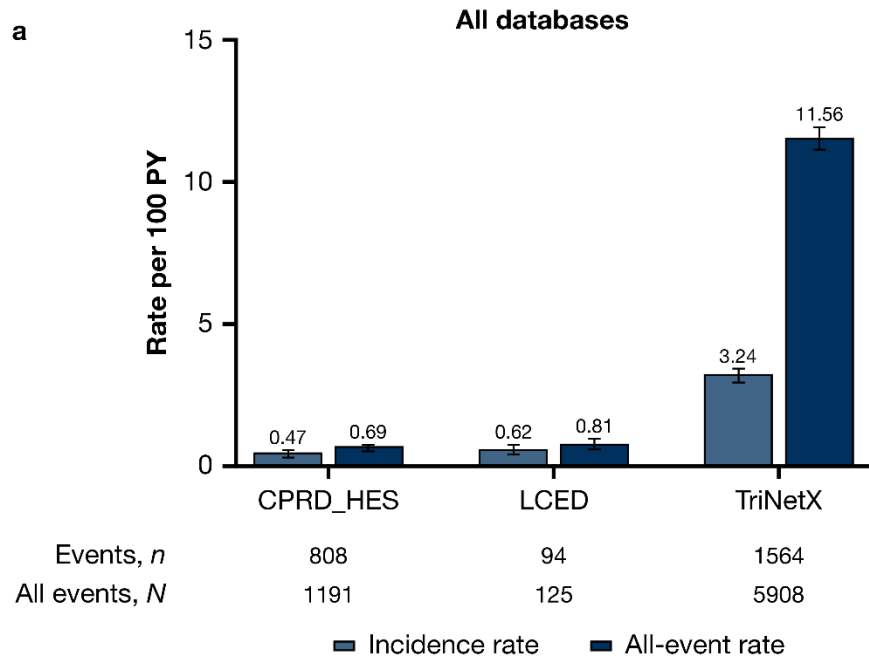
Iron (µg/dL)	UACR (mg/g)	0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	84.4	77.9	72.7	81.4	69.3	75.3	70.8	68.3	70.9
	45-60	82.0	71.8	59.5	80.6	70.6	73.6	66.2	63.2	60.2
	30-45	72.5	72.9	62.5	73.2	73.8	63.7	70.7	66.6	65.1
	15-30	74.6	59.3	69.2	109.3	55.0	63.1	64.1	59.5	57.0
	0-15	NA	73.5	49.7	73.0	40.8	48.0	74.4	50.9	55.6

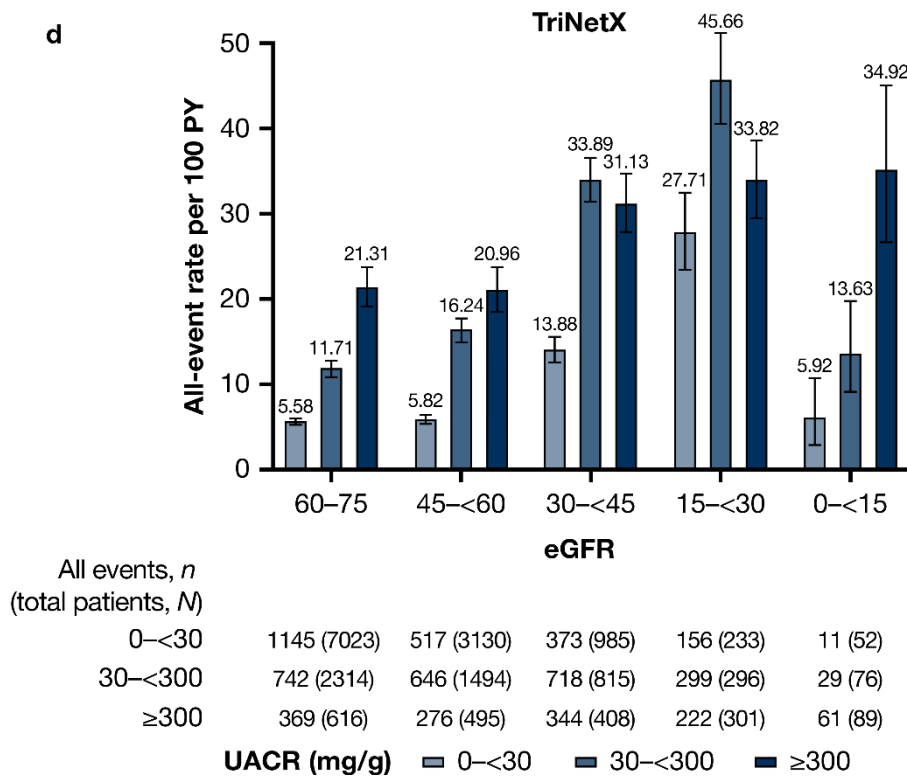
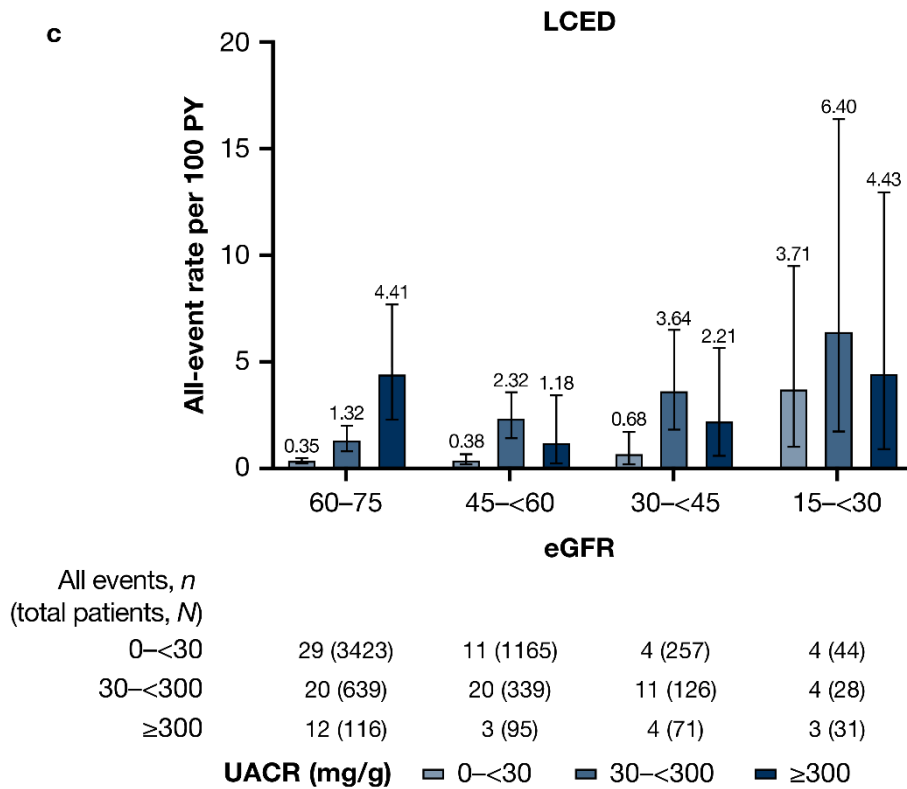
Parathyroid parathyroid (pg/ml)	UACR (mg/g)	0- <30	30- <300	≥300	0- <30	30- <300	≥300	0- <30	30- <300	≥300
eGFR (ml/min/1.73 m ²)	60-75	76.0	63.8	55.6	NA	NA	NA	NA	NA	NA
	45-60	81.7	80.4	161.3	NA	NA	NA	NA	NA	NA
	30-45	77.9	84.4	110.3	NA	NA	NA	NA	NA	NA
	15-30	88.4	272.3	129.3	NA	NA	NA	NA	NA	NA
	0-15	147.1	194.7	194.2	NA	NA	NA	NA	NA	NA

BNP, brain natriuretic peptide; CPRD, Clinical Practice Research Datalink; CRP, C-reactive protein; eGFR, estimated glomerular filtration rate; Hb, hemoglobin; HDL, high density lipoprotein cholesterol; K⁺, potassium; KDIGO, Kidney Disease: Improving Global Outcomes; LCED, Limited Claims and Electronic Health Record Dataset; LDL, low density lipoprotein cholesterol; TIBC, total iron binding capacity; UACR, urinary albumin-to-creatinine ratio; WBC, white blood cell.

Mean values are shown; color coding is based on quartiles (Q) for each parameter within each database: green = Q1 and below; yellow = Q1 to Q2; orange = Q2 to Q3; red = Q3 and above.

Supplementary Figure 6. Incidence rates^a and all-event rates^b per 100 PY of hospitalization for heart failure: (a) overall and by (b, c, d) KDIGO category.





CI, confidence interval; CPRD, Clinical Practice Research Datalink; eGFR, estimated glomerular filtration rate; HF, heart failure; HES, hospital episode statistics; LCED, Limited Claims and Electronic Health Record Dataset; PY, person-years; UACR, urinary albumin-to-creatinine ratio.

Error bars represent 95% CI. Note: TriNetX does not record a primary diagnosis during hospitalization, meaning that data show inpatient events where HF is recorded, and therefore, not necessarily the primary diagnosis.

^aCalculated as the number of specific events that occur during patient follow-up time at risk (time in the study until first event or loss to follow-up).

^bCalculated as the total number of events that occurred during patient follow-up time at risk (patients' time until loss to follow-up).

Supplementary Figure 7. Incidence rates per 100 PY of clinical outcomes^a during follow-up by KDIGO category (sensitivity analysis).

≥50% eGFR decline	UACR (mg/g)	CPRD			LCED			TriNetX		
		0<-30	30-<300	≥300	0<-30	30-<300	≥300	0<-30	30-<300	≥300
eGFR (ml/min/1.73 m ²)	60-75	0.12 (0.09-0.15)	0.44 (0.33-0.58)	2.62 (1.84-3.61)	0.08 (0.02-0.18)	0.47 (0.15-1.11)	1.67 (0.34-4.88)	0.19 (0.13-0.27)	0.59 (0.39-0.85)	2.88 (2.02-3.99)
	45-<60	0.13 (0.09-0.18)	0.39 (0.27-0.56)	1.76 (1.06-2.74)	0.18 (0.05-0.46)	NA	3.32 (1.22-7.23)	0.31 (0.19-0.47)	0.73 (0.45-1.12)	4.19 (2.98-5.73)
	30-<45	0.15 (0.07-0.27)	0.46 (0.24-0.80)	1.63 (0.78-3.00)	NA	NA	4.83 (1.77-10.52)	0.59 (0.30-1.03)	1.36 (0.84-2.07)	4.76 (3.33-6.59)
	15-<30	0.88 (0.32-1.92)	NA	3.11 (1.34-6.13)	NA	NA	NA	1.68 (0.67-3.46)	NA	8.03 (5.66-11.08)
	0-<15	NA	NA	NA	NA	NA	NA	NA	1.71 (0.35-4.99)	4.93 (1.98-10.16)
Kidney failure	60-75	0.01 (0.00-0.02)	0.03 (0.01-0.09)	1.17 (0.68-1.88)	0.05 (0.01-0.13)	NA	NA	0.04 (0.01-0.08)	0.25 (0.13-0.44)	1.01 (0.54-1.73)
	45-<60	0.02 (0.01-0.04)	0.12 (0.05-0.22)	1.37 (0.77-2.26)	0.13 (0.03-0.39)	NA	2.70 (0.88-6.29)	0.04 (0.01-0.13)	0.28 (0.12-0.55)	2.20 (1.36-3.37)
	30-<45	0.07 (0.02-0.17)	0.27 (0.11-0.55)	3.45 (2.14-5.27)	NA	NA	4.73 (1.74-10.29)	0.34 (0.14-0.71)	1.23 (0.74-1.91)	4.92 (3.47-6.79)
	15-<30	1.80 (0.93-3.15)	2.47 (1.41-4.02)	11.88 (7.83-17.28)	NA	6.40 (1.32-18.71)	22.85 (11.40-40.88)	3.67 (2.06-6.06)	2.11 (1.01-3.88)	22.13 (17.77-27.23)
	0-<15	NA	14.33 (7.15-25.64)	41.71 (23.34-68.79)	NA	NA	NA	1.94 (0.40-5.66)	7.97 (4.24-13.82)	48.33 (35.51-64.26)
hHF	60-75	0.28 (0.24-0.33)	0.90 (0.73-1.09)	1.33 (0.80-2.07)	0.28 (0.16-0.44)	1.05 (0.53-1.88)	3.98 (1.60-8.20)	1.67 (1.47-1.88)	3.94 (3.38-4.56)	5.44 (4.20-6.94)
	45-<60	0.45 (0.38-0.53)	0.82 (0.63-1.05)	1.58 (0.92-2.53)	0.36 (0.15-0.7)	1.68 (0.80-3.09)	NA	2.12 (1.78-2.50)	4.51 (3.74-5.38)	6.63 (5.05-8.56)
	30-<45	0.92 (0.71-1.18)	1.80 (1.33-2.40)	1.66 (0.79-3.04)	NA	2.95 (1.08-6.42)	2.41 (0.50-7.05)	3.83 (3.00-4.80)	8.32 (6.88-9.96)	13.22 (10.60-16.28)
	15-<30	2.85 (1.72-4.45)	1.68 (0.84-3.01)	1.92 (0.62-4.48)	3.46 (0.71-10.12)	NA	6.25 (1.29-18.27)	9.29 (6.51-12.86)	15.37 (11.78-19.70)	13.94 (10.67-17.91)
	0-<15	NA	NA	NA	NA	NA	NA	3.31 (1.07-7.72)	3.50 (1.28-7.61)	12.75 (7.43-20.41)
Stroke	60-75	0.78 (0.71-0.86)	1.09 (0.91-1.30)	2.34 (1.61-3.29)	5.45 (4.88-6.08)	10.26 (8.28-12.57)	10.66 (6.21-17.06)	4.12 (3.79-4.46)	5.59 (4.91-6.34)	5.40 (4.17-6.89)
	45-<60	0.97 (0.86-1.09)	1.34 (1.09-1.63)	1.66 (0.98-2.63)	6.83 (5.73-8.07)	12.16 (9.33-15.59)	11.01 (6.41-17.62)	5.34 (4.78-5.94)	6.64 (5.68-7.70)	8.18 (6.38-10.34)
	30-<45	1.61 (1.32-1.94)	1.94 (1.44-2.56)	1.99 (1.03-3.47)	10.13 (7.20-13.85)	14.56 (9.42-21.49)	11.20 (5.79-19.56)	6.29 (5.19-7.54)	9.28 (7.74-11.05)	8.33 (6.33-10.77)
	15-<30	2.99 (1.83-4.62)	1.99 (1.06-3.41)	2.69 (1.08-5.53)	9.27 (3.73-19.11)	11.83 (3.84-27.61)	13.23 (4.86-28.80)	8.15 (5.50-11.63)	10.68 (7.76-14.33)	6.86 (4.66-9.73)
	0-<15	NA	NA	NA	NA	NA	NA	1.97 (0.41-5.76)	6.84 (3.41-12.23)	6.99 (3.35-12.85)

MI	UACR (mg/g)	0<30	30<300	≥300	0<30	30<300	≥300	0<30	30<300	≥300
eGFR (ml/min/1.73 m ²)	60-75	1.36 (1.27-1.46)	2.10 (1.84-2.38)	2.64 (1.86-3.64)	2.33 (1.96-2.73)	5.06 (3.76-6.68)	9.55 (5.46-15.51)	2.42 (2.16-2.68)	4.20 (3.63-4.85)	4.70 (3.56-6.08)
	45<60	1.38 (1.25-1.52)	1.87 (1.57-2.20)	3.42 (2.40-4.74)	3.29 (2.57-4.16)	5.87 (4.04-8.24)	3.38 (1.24-7.35)	2.83 (2.44-3.27)	4.44 (3.68-5.31)	6.41 (4.84-8.33)
	30<45	2.00 (1.67-2.37)	1.98 (1.47-2.60)	2.68 (1.53-4.36)	5.94 (3.84-8.77)	6.92 (3.78-11.61)	6.84 (2.95-13.48)	3.74 (2.92-4.70)	6.98 (5.68-8.50)	8.58 (6.56-11.02)
	15<30	3.32 (2.08-5.03)	3.32 (2.06-5.08)	2.34 (0.86-5.09)	5.90 (1.92-13.77)	NA	6.13 (1.26-17.92)	5.88 (3.72-8.82)	6.56 (4.40-9.43)	8.71 (6.20-11.91)
	0<15	NA	3.34 (0.69-9.77)	NA	NA	NA	NA	NA	2.95 (0.96-6.88)	7.06 (3.39-12.99)
All-cause mortality	UACR (mg/g)	0<30	30<300	≥300	0<30	30<300	≥300	0<30	30<300	≥300
eGFR (ml/min/1.73 m ²)	60-75	1.22 (1.13-1.31)	2.62 (2.33-2.93)	4.39 (3.38-5.61)	NA	NA	NA	0.84 (0.70-0.99)	1.50 (1.17-1.89)	1.95 (1.26-2.88)
	45<60	2.09 (1.93-2.26)	4.17 (3.73-4.66)	5.17 (3.92-6.70)	NA	NA	NA	0.94 (0.72-1.20)	2.48 (1.93-3.13)	2.31 (1.45-3.50)
	30<45	4.46 (3.97-4.99)	7.74 (6.72-8.88)	6.31 (4.48-8.62)	NA	NA	NA	1.03 (0.64-1.58)	2.40 (1.69-3.31)	2.59 (1.58-4.00)
	15<30	9.91 (7.69-12.56)	12.54 (9.98-15.54)	10.61 (7.05-15.34)	NA	NA	NA	3.84 (2.19-6.23)	3.62 (2.11-5.80)	3.27 (1.87-5.31)
	0<15	5.85 (1.21-17.10)	14.16 (7.54-24.22)	NA	NA	NA	NA	1.97 (0.41-5.76)	2.27 (0.62-5.82)	5.33 (2.30-10.51)
CV mortality	UACR (mg/g)	0<30	30<300	≥300	0<30	30<300	≥300	0<30	30<300	≥300
eGFR (ml/min/1.73 m ²)	60-75	0.29 (0.25-0.33)	0.71 (0.56-0.88)	1.03 (0.58-1.70)	NA	NA	NA	NA	NA	NA
	45<60	0.43 (0.36-0.51)	0.82 (0.63-1.05)	1.81 (1.11-2.80)	NA	NA	NA	NA	NA	NA
	30<45	1.18 (0.94-1.47)	1.59 (1.15-2.15)	1.29 (0.56-2.55)	NA	NA	NA	NA	NA	NA
	15<30	2.04 (1.11-3.42)	1.96 (1.05-3.36)	1.89 (0.62-4.42)	NA	NA	NA	NA	NA	NA
	0<15	NA	3.27 (0.67-9.55)	NA	NA	NA	NA	NA	NA	NA

CI, confidence interval; CPRD, Clinical Practice Research Datalink; CV, cardiovascular; eGFR, estimated glomerular filtration rate; hHF, hospitalization for heart failure; KDIGO, Kidney Disease: Improving Global Outcomes; LCED, Limited Claims and Electronic Health Record Dataset; MI, myocardial infarction; NA, not available (owing to low patient/event numbers); PY, patient-years; UACR, urinary albumin-to-creatinine ratio. Data are incidence rate (95% CI), calculated as the number of specific events that occur during patient follow-up time at risk (time in the study until first event or loss to follow-up). Color coding is based on odds ratio quartile (Q) for each outcome within each database: green = Q1 and below; yellow = Q1 to Q2; orange = Q2 to Q3; red = Q3 and above.

^aMortality data were not available for US LCED and incidence rates for some outcomes were not available where there were low patient or event numbers (e.g., LCED eGFR <15 ml/min/1.73 m²).

How Clinical Guidelines for CHRONIC KIDNEY DISEASE

Have Been Used in the Real World Since 2012

WHAT WAS THE FOCUS OF THE STUDY?

Estimated glomerular filtration rate (eGFR) and urinary albumin-to-creatinine ratio (UACR) are two key tests for chronic kidney disease (CKD) that can help doctors, patients, and caregivers predict and manage the risk of CKD complications.

eGFR test

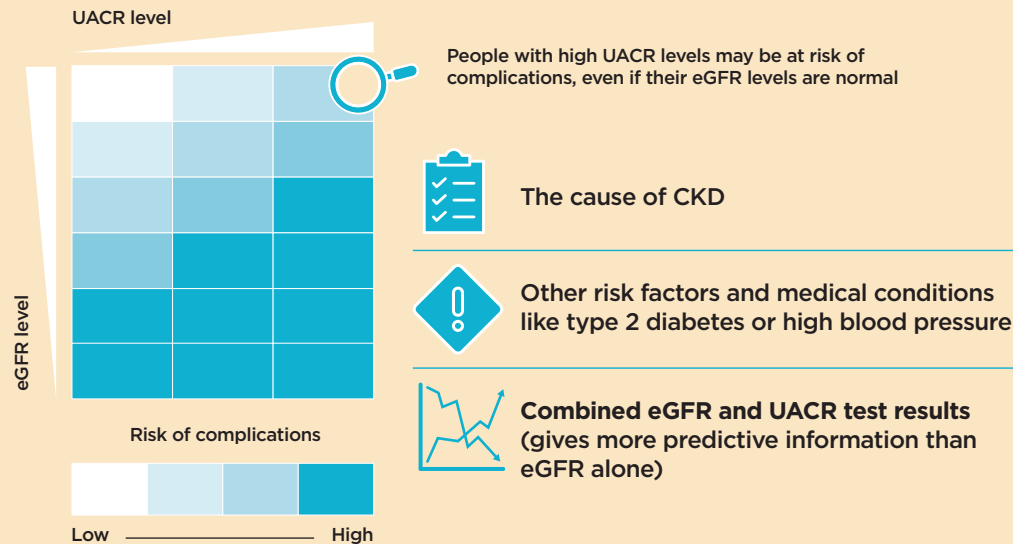
Shows how well a person's kidneys are **functioning** by measuring a waste product called creatinine in the blood.



UACR test

Measures whether a type of protein called albumin has leaked from the kidneys into the urine due to **kidney damage**.

We can predict the risk of serious complications of CKD by looking at:



WHAT WAS THE AIM OF THIS STUDY?



To understand more about the characteristics, medication use, and health outcomes of people living with CKD.



To see whether healthcare professionals are following the guideline recommendations on testing eGFR and UACR levels.

RESEARCHERS WANTED TO FIND OUT...

How do characteristics, treatments, and outcomes change for patients with less or more severe CKD as defined in the guidelines?

How often are eGFR and UACR tests carried out on people living with CKD?

HOW WAS THE STUDY CARRIED OUT?

This ongoing real-world study called DISCOVER CKD looked back at data collected from three large databases of patient medical records:

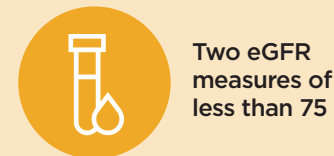


Patients with type 1 diabetes, or who had received a kidney transplant or were receiving dialysis were not included in this study.

Researchers looked at the anonymized medical records of



Patients eligible for the study



The following health outcomes were tested:

50%↓

Kidney disease getting worse (a sustained 50% reduction in eGFR or development of kidney failure).



Heart problems (heart attack, stroke, or hospitalization for heart failure).



Loss of life from any cause, or loss of life caused by disease of the heart and blood vessels (cardiovascular disease).

WHAT WERE THE RESULTS OF THE STUDY?

Many people with CKD included in the study were categorized by the clinical guidelines as being in the low or moderately increased risk groups for CKD complications. The proportion of participants in each risk group was:

CKD risk group

Across-database range

38.3–53.9%

Low risk

28.4–32.5%

Moderately increased risk

11.2–17.0%

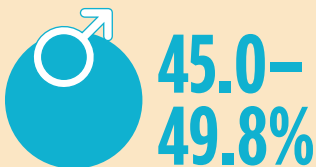
High risk

5.9–15.1%

Very high risk

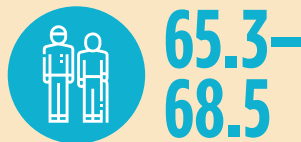
In this study...

PARTICIPANTS THAT WERE MEN



Across-database range

MOST PARTICIPANTS WERE AGED BETWEEN



Years

THE AVERAGE TIME THAT PATIENTS WERE FOLLOWED IN THE DATABASE FOR WAS



Years

Of **1,521,715** people with 2 eGFR measures in the medical databases, only **8.6%** had 1 or more UACR measure(s) and could be included in the study

As eGFR decreased and UACR increased:



There was increased risk of kidney disease getting worse, heart problems, and loss of life.



Prescriptions for some CKD medicines increased.



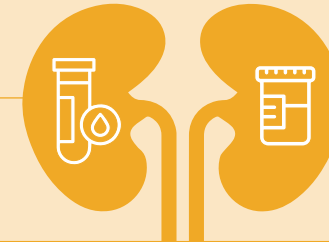
Occurrence of other medical conditions, such as type 2 diabetes and high blood pressure, tended to increase.

eGFR and UACR were tested less often than the recommended once per year for low risk patients, and 3 to 4 or more times per year for very high risk patients

The average number of tests per year were:

eGFR

1.6–2.5



UACR

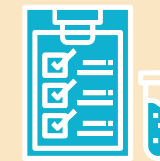
0.5–0.6

Across-database range

WHAT DO THESE RESULTS MEAN FOR PEOPLE LIVING WITH CKD?



eGFR and UACR levels are linked with the expected health outcomes of people living with CKD.



More regular testing for all people living with CKD is recommended for monitoring the risk of kidney disease getting worse, heart disease, and loss of life.



Where can I find more information on this study?

You can read the full medical paper by James G et al. Low Adherence to KDIGO 2012 CKD Clinical Practice Guidelines Despite Clear Evidence of Utility.



Who funded this study?

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